

## CLAIMS

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1. A system for measuring tape pack radii, comprising:
- a tape supply reel, said tape supply reel rotating as a tape leaves said tape supply reel during a tape transfer process;
  - a tape take-up reel for receiving tape from said tape supply reel, said tape take-up reel rotating as it receives said tape during said tape transfer process;
  - an at least one encoder responsive to movement of said tape;
  - a first angular position transducer to measure an angular position of said tape supply reel;
  - a second angular position transducer to measure an angular position of said tape take-up reel;
  - a third transducer responsive to said at least one encoder;
  - a Kalman filter, responsive to one or both of an angular position measurement by said first angular position transducer and an angular position measurement by said second angular position transducer and also responsive to an angular position measurement by said third angular position transducer, to calculate an updated estimate of one or both of a supply radius of a tape pack on said tape supply reel and a take-up radius of a tape pack on said tape take-up reel;
  - a servo-controller, responsive to one or both of said supply radius and said take-up radius, to control rotation of said tape supply reel and said tape take-up reel.
2. The apparatus as in claim 1, wherein said Kalman filter further comprises:
- a supply Kalman filter responsive to said first angular position transducer and said third angular position transducer;
  - a take-up Kalman filter responsive to said second angular position transducer and said third angular position transducer.

3. The apparatus as in claim 1 wherein said at least one encoder further comprises:  
a first encoder responsive to an angular position of a supply reel tension arm;  
a second encoder responsive to an angular position of a take-up reel tension arm.

4. The apparatus as in claim 1, further comprising:  
a capstan, said tape contacting said capstan and said capstan rotating as said tape transfers from said tape supply reel to said tape take-up reel.

5. The apparatus as in claim 3 wherein said at least one encoder further comprises:  
a third encoder responsive to an angular position of a capstan.

6. The apparatus as in claim 1 further comprising:  
a tape length estimator responsive to said Kalman filter to determine the amount  
of tape available for a record operation.

7. A system for measuring a length of tape available for a record operation, comprising:  
a tape supply reel, said tape supply reel rotating as a tape leaves said tape supply reel during a tape transfer process;  
a tape take-up reel for receiving tape from said tape supply reel, said tape take-up reel rotating as it receives said tape during said tape transfer process;  
an at least one encoder responsive to movement of said tape;  
a first angular position transducer to measure an angular position of said tape supply reel;  
a second angular position transducer to measure an angular position of said tape take-up reel;  
a third transducer responsive to said at least one encoder;  
a Kalman filter, responsive to one or both of an angular position measurement by said first angular position transducer and an angular position measurement by said second angular position transducer and also responsive to an angular position measurement by

said third angular position transducer, to calculate said length of tape available for a record operation.

8. A method for estimating a radius of a tape on a supply reel and on a take-up reel,  
5 comprising:

measuring a first angular position of a tape supply reel;

measuring a second angular position of a tape take-up reel;

measuring a third angular position responsive to movement of a tape; and,

10 estimating by a Kalman filter a radius of a tape pack on said supply reel and a radius of a tape pack on said take-up reel, in response to said first angular position of said tape supply reel, said second angular position of said tape take up reel, and said third angular position responsive to movement of said tape.

9. The method as in claim 8 wherein said estimating step by said Kalman filter further  
15 comprises:

responding to an initial estimate of said radius of a tape pack on said supply reel;

responding to an initial estimate of a radius of tape pack on said take-up reel;

and,

20 responding to said first angular position measurement, said second angular position measurement, and said third angular position measurement to compute said radius of said tape pack on said supply reel and said radius of said tape pack on said take-up reel.

10. The method of claim 8 further comprising:

25 making said first angular measurement at a first regular time interval;

making said second angular measurement at a second regular time interval;

making said third angular measurement at a third regular time interval.

11. The method of claim 10 further comprising:

30 choosing said first regular time interval, said second regular time interval and said third regular time interval each to be approximately 20 milliseconds.

12. A method for estimating a length of tape available for a record operation, comprising:

measuring a first angular position of a tape supply reel;

measuring a second angular position of a tape take-up reel;

measuring a third angular position responsive to movement of a tape; and,

estimating by a Kalman filter said length of tape available for a record operation,

in response to said first angular position of said tape supply reel, said second angular

position of said tape take up reel, and said third angular position responsive to movement

of said tape.

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